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Case Report

The impact of an “aha” moment on gender biases: Limited evidence for the efficacy of a game intervention that challenges gender assumptions

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ABSTRACT

In two studies, the present research tested whether a paper-based game intervention that guides participants into understanding and questioning their assumptions about gender can decrease biases. Participants in Study 1 ($N = 143$ college students) and Study 2 ($N = 341$ high school students) played a game in which they either had to realize that a scientist character was a woman (Intervention condition) or a professor (Control condition) to solve the mystery. Across both studies, in a game with a storyline that included both male and female scientists, the vast majority of students who used gendered pronouns assumed that non-gendered scientist characters were men. In Study 1, playing the Intervention version of the game had no effect on college students' explicit or implicit attitudes toward women in science. In Study 2, there was a positive effect of the Intervention condition on implicit attitudes: participants in the Intervention condition were less likely to describe a female professor as a man than were participants in the Control condition. However, there was a negative effect of the Intervention condition on explicit attitudes toward women in science. Taken together, the present research points to the continued need for research on raising awareness of bias and developing interventions that can decrease biases while avoiding defensiveness.

The impact of biases against women in science is clear: women are underrepresented in STEM (science, technology, engineering, and math) fields (National Science Foundation, 2017) and often experience hostile working environments (Beasley & Fischer, 2012; Clancy, Nelson, Rutherford, & Hinde, 2014; Reuben, Sapienza, Zingales, & Greenwald, 2014). But what happens when people are made aware that they may exhibit their own biased assumptions? When individuals are confronted with evidence of their biases, they sometimes respond defensively (Frantz, Cuddy, Burnett, Ray, & Hart, 2004; Hillard, Ryan, & Gervais, 2013; Howell et al., 2013; Howell, Gaither, & Ratliff, 2015; Howell & Ratliff, 2017). For example, when participants expect feedback from an Implicit Association Test (Greenwald, McGhee, & Schwartz, 1998) to indicate biased intergroup preferences (i.e., negative feedback), they opt to not learn the results and regret learning them if they do find out (Howell et al., 2013). Even the knowledge that a test may potentially reveal biases can lead to defensiveness and, paradoxically, produce higher bias scores (Frantz et al., 2004). Furthermore, individuals are prone to interpret published research about stereotypes in a biased fashion if the research implicates their identity has one that engages in prejudicial acts (Handley, Brown, Moss-Racusin, & Smith, 2015).

There have been a few interventions that have effectively utilized confrontational strategies, particularly for confronting individuals about racial bias. These racial bias confrontations have been shown to reduce prejudiced attitudes and to induce negative self-directed emotions (Czopp & Monteith, 2003; Czopp, Monteith, & Mark, 2006; Gulker, Mark, & Monteith, 2013). The impact of confronting individuals about gender biases, however, has been mixed with participants feeling dismissive about gender bias related confrontations (Gulker et al., 2013). For example, although a series of confrontations about gender biases were successful in inducing negative self-directed emotions and increasing concern about being prejudiced in the future, they also increased participants' likelihood of responding defensively by devaluing women in science and thinking that the researchers who mentioned gender biases were overly sensitive (Parker, Monteith, Moss-Racusin, & Van Camp, 2018).

Thus, an important open question is whether there are ways to create interventions for combating gender biases that both reduce prejudicial thoughts and avoid increasing defensiveness. In other

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words, how can evidence of personal biases be presented to individuals in a way to would invite greater receptivity and less rejection? One promising strategy has emerged in the domain of persuasion. Dispelling participants' illusion of invulnerability to illegitimate appeals (i.e., making people aware that they are vulnerable to persuasive attempts regardless of their legitimacy) reduces susceptibility to such appeals – but information alone is not enough. Individuals have to be fooled and have the mistake pointed out to them (Sagarin, Cialdini, Rice, & Serna, 2002).

The present work applies this strategy (i.e., producing an "aha" moment) to illuminate and dispel biased assumptions about gender in STEM domains. Despite attempts to increase the representation of women across STEM fields (Moss-Racusin et al., 2014), a large gender gap still exists (National Science Foundation, 2017), and this imbalance is perpetuated by stereotypes about the ability of women to excel in STEM domains (Hill, Corbett, & St. Rose, 2010). The present work employs a game-based intervention as a less-threatening context in which to confront biases. Games are a promising avenue for persuasive intervention because they can provide a less explicit—and thus, psychologically safer—means of dealing with difficult issues (Bessarabova et al., 2016; Dunbar et al., 2014), particularly if they are designed with the possibility of defensiveness in mind (Kaufman, Flanagan, & Seidman, 2015). Furthermore, interventions to combat biases are particularly effective when they involve active participation rather than passive learning, as demonstrated by the WAGES intervention—a game intervention in which participants learn about biases against women by attempting to become a Distinguished Professor (Shields, Zawadzki, & Johnson, 2011). Games by definition involve active participation and may therefore be a useful context for creating an intervention combating biases against women in science. The present research introduces a novel intervention in which participants play a logic-puzzle game that they can only win by realizing that one of the scientist characters is a woman. Across the two studies, the hypotheses were that playing the intervention version of the game compared to the control version of the game would increase positive attitudes toward women in science and reduce sexism. In Study 1, we also hypothesized that playing the intervention version compared to the control version would increase monetary allocations to women in STEM organizations. We report all measures, manipulations, and exclusions in these studies.

1. Study 1

Study 1 examined the impact of experiencing an "aha" moment about assumptions about women in science on subsequent attitudes toward women in science. Undergraduate students played a logic mystery game in which the solution hinged on recognizing and correcting gender assumptions.

1.1. Method

1.1.1. Participants

Based on the results of a power analysis with 80% power and an expected effect size of $d = 0.47$ (Sagarin et al., 2002), we aimed to recruit 146 participants from undergraduate housing communities. One hundred forty-four college students participated; one participant was excluded for knowing the study's purpose, leaving a final sample of 143 participants (77 men, 65 women, 1 did not report gender; $M_{age} = 20.29$, $SD_{age} = 1.04$).

1.1.2. Procedure

After providing consent, participants were randomly assigned to pairs and to conditions. In sessions in which there were an uneven number of participants, one group played in a group of three—there were a total of three groups of three and the rest of the groups were pairs. During development of the game, undergraduate students were asked to playtest the game to test its length and how enjoyable it was. No formal data were collected, but playtest observations revealed that the players who did the game on their own took longer and seemed less interested than players who were allowed to work in groups or pairs. Therefore, the research team made the decision to have participants in Study 1 and 2 play in pairs or groups. The study was conducted at the students' housing locations. Therefore, all of the students knew each other within each session. Participants were randomly handed an index card with an ID number on it. Based on the last two digits of the ID, participants found their pair. Thus, pairs were randomly assigned. Most of the housing locations were single sex, which resulted in 34 male pairs/groups, 29 female pairs/groups, and 7 mixed pairs/groups.

In the study, participants were told that they had 35 min to solve a mystery in which a dangerous disease sample went missing from a lab. Participants were given maps of the building, logs of who entered and left each room, and notes from the FBI director (see Supplementary materials). In the Control condition, participants could solve the mystery by realizing that one of the characters was a professor, and that the sample had been hidden in a faculty-only bathroom. In the Intervention condition, participants could solve the mystery by realizing that one of the characters (a scientist) was a woman, and that the sample had been hidden in a women's bathroom. In both conditions, participants within pairs worked together to solve the mystery; the experimenters did not dictate how the pairs should engage in the task. From informal observation, pairs differed in their strategies. Some pairs read the documents separately before speaking with each other, whereas others began talking earlier in the process.

All characters were assigned gender ambiguous names. The Officer and the Rival Researcher were described using masculine pronouns, the Assistant Professor was described using feminine pronouns, and the Lab Head was not gendered. The Second in Command was gendered as a woman in the Control condition and not gendered in the Intervention condition. Participants individually completed an answer sheet in which they recorded the two-part answer—the sample's location and the thief's identity—as well as a statement about each character's guilt, which was used to assess participants' use of gendered pronouns as an implicit measure of gender bias (Fazio & Olson, 2003). After completing this answer sheet, an experimenter guided each pair to the correct answer and the reasoning behind it to ensure that all participants had the "aha" moment (see Supplementary Material). Participants then completed the questionnaires.

1.1.3. Measures

The questionnaires included a monetary allocation task in which participants had to allocate $500 among fourteen college organizations, two of which supported women in STEM; a shortened version of the Attitudes Toward Women in Science Scale (ATWSS; Erb & Smith, 1984); the Ambivalent Sexism Inventory (ASI; Glick & Fiske, 1996); and demographics.

1.2. Results

1.2.1. Solving the game

Overall, 23.1% of the participants solved the game on their own prior to the explanation from the experimenter. Solving the game was defined as correctly identifying the thief and correctly identifying the location of the stolen sample. A binary logistic regression found no main effects of gender ($b = 0.42$, $SE = 0.56$, $p = .456$), condition ($b = 0.18$, $SE = 0.55$, $p = .737$), or their interaction ($b = -0.56$, $SE = 0.80$, $p = .485$).

1.2.2. Character pronouns

Responses using gendered pronouns were analyzed for frequency of masculine versus feminine pronouns (see Table 1). Fifty-eight of the 143 participants provided a gendered pronoun for the Lab Head and the Assistant Professor. For the Lab Head (who was not gendered), 96.6% of participants who used a gendered pronoun used a masculine pronoun.